Equilibrium Online Lab

Go to the website http://dept.harpercollege.edu/chemistry/chm/100/dgodambe/thedisk/equil/equil.htm .

Background:

Include the following information in well as researched background (on Le Chatelier's Principle and Equilibrium), in the background section of your lab report.

Read the ***Background*** information concerning equilibrium and continue to Le Chatelier's Principle and Equilibrium changes. You should reach a point where you see Le Chatelier's Principle – Changes in Concentration and the equation $H_2 + I_2 \rightleftharpoons 2\ HI$. Read the material provided on this page and answer questions 1 through 4 by filling in the table provided. Check your answer when finished by clicking the link provided at the bottom of the page.

Applied stress	Direction of shift	Effect on [H_2]	Effect on [I_2]	Effect on [HI]
I_2 added				
I_2 removed				
HI added				
HI removed				

NOTE: indicate shift right (creates more products), shift left (creates more reactants) or no change (no effect on reaction).

When you arrive at the next page, you will see Le Chatelier's Principle – Changes in Temperature at the top of the page. Review the material on this page and perform the practice problem by filling out the table provided. Check your answer by clicking the link.

Applied stress	Direction of shift	Effect on [H_2]	Effect on [I_2]	Effect on [HI]
Temp. decreased				

Move on to the ***PreLab*** section by clicking the link provided. Perform only the first Prelab section as provided below.

Prelab:

1. Which describes a system at equilibrium? One in which the color of the solution changing slowly, or one in which the color is not changing. Justify your answer.

2. For the reaction: Heat + $Cu(H_2O)_6^{2+} + 4Br^- \rightleftharpoons 6\ H_2O + CuBr_4^{2-}$.
   a. What happened to the concentration of each of the ions when the KBr was added?
   b. Explain why the solution changed color.
   c. Would the tube feel hot or cold when the KBr was added?

Procedure:

For your lab report write a procedure based upon the experiments performed as if the experiments were performed by you. For example, your procedure should not include “click on icon” but rather “add heat and observe.”

Move on to the ***Experiment*** section by clicking the link provided at the bottom of the page. At the top left of the page, click the “An Example” link to see what each icon represents.
Perform only labs I, III and V.
In these experiments you will be shown a series of equilibrium systems and asked to apply certain "stresses" to the systems. The results of applying the stress will then be shown to you. For each system, record:

a. The name of the equilibrium system, include the reaction as well.
b. Your observations - This means a color change, a precipitate formed or some like statement. For example, "the red solution turned green". Do not use this part to state what chemical change occurred. For example, you should not say "more cobalt ion was formed".
c. What you think happened chemically - State what chemical reaction occurred or species was formed that resulted in your observation. For example, "by adding chloride ion to the solution it shifted the equilibrium to the left which caused more CoCl4-2 ion to be formed. Since this ion is blue, the solution became more blue."

Data:

Experiment I:
Name / Equation:
Heat:
Cool:
Add H_2O:
Add KCl:
Add $AgNO_3$:

Experiment III:
Name / Equation:
Add KSCN:
Add $Fe(NO_3)_2$:
Heat:
Add Na_2HPO_4:

Experiment V:
Name / Equation:
Heat:
Cool:

Conclusion:
In your own words, write a paragraph or two to generalize what happens in a chemical reaction at equilibrium when a stress or change is made on the system. Explain using specific examples from the lab.

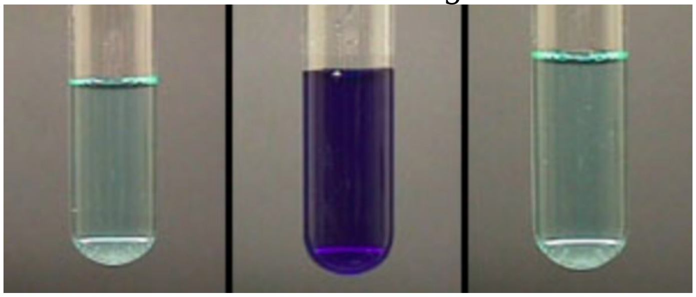
Post lab question:

1. Consider the following reaction at equilibrium: $NH_{3\,(g)} \rightleftharpoons H_{2\,(g)} + N_{2\,(g)} + \text{Heat}$. Predict what will happen to each chemical concentration if we
    a. Add heat
    b. Remove NH_3
    c. Remove H_2
    d. Increase the pressure of the contain

2. Consider the following equilibrium.

$$Cu^{+2} + 4\,NH_3 \rightleftharpoons Cu(NH_3)_4^{+2}$$

The copper ion in solution is light blue. The $Cu(NH_3)_4^{+2}$ ion is a deep blue. The tube on the left contains only copper ions. Identify what chemical was added to produce the results shown in the center tube. Identify what chemical may have been added to the center tube to produce the results shown in the right tube.



Extension questions:

1. The barium ion is toxic to humans. However, barium sulfate is commonly used as an image enhancer for gastrointestinal x-rays. What does this imply about the position of the equilibrium shown below.

$$BaSO_4 \rightleftharpoons Ba^{+2} + SO_4^{-2}$$

2. Hemoglobin (Hb) and oxygen gas form a complex (HbO_2) that carries oxygen throughout the human body. Unfortunately, carbon monoxide also binds to hemoglobin so that an equilibrium is established. Carbon monoxide poisoning occurs when the concentration of HbO_2 in the blood is reduced.

$$HbO_2 + CO \rightleftharpoons HbCO + O_2$$

The first aid for a person suffering from carbon monoxide poisoning is to (1) remove them to an area of fresh air, and (2) administer oxygen. Using the principles of equilibrium, explain how each of these helps to restore the HbO2 concentration.